## I. *Some Remarks on a late Eſſay of Mr.* Caſſini, *wherein he propoſes to find, by Obſervation, the Parallax and Magnitude of* Sirius. *By* Edmund Halley, LL.D. R. S. S.

IN the *Memoires* of the *Royal Academie* of *Paris*, for the Year 1717. but now very lately publiſhed, there is one very remarkable Eſſay, by Mr. *Caſſini*, concerning the *Annual Parallax* of the *Fix'd Stars*, and particularly of *Sirius*; and in concluſion, he determines the Diameter of *Sirius* to be as much bigger than that of the *Sun*, as the *Sun*'s is greater than that of the *Earth*, which he ſuppoſes to be 100 times: And the diſtance from the *Sun* to the *Earth* being certainly about 100 Diameters of the *Sun*, it will follow, that the Globe of *Sirius* muſt be a Sphere, whoſe Diameter muſt equal the diſtance between the *Earth* and *Sun*.

To prove this, he tells us that he made uſe of an excellent Teleſcope of 34 *French* Feet, or 36 *Engliſh*, leaving an Aperture of but an Inch and half, to take off the ſpurious Rays of the *Star*, which then appeared round, and ſufficiently well defined; and comparing his Body to that of *Jupiter*, which he ſays, was then 50 Seconds Diameter, he found that the Diameter of *Jupiter* was ten times greater than that of the Star, which by conſequence was ſeen under an Angle of about 5 Seconds; which is his firſt Poſition.

Then he tells us, that to make the Obſervations of the Parallax of this Star with all the exactneſs poſſible, he employed a Teleſcope of *three Foot*, in a Copper

Tube, having fixed in the common *Focus* of the two Glaſſes, four threads croſſing one another in the Center, under Angles of 45 Degrees. This Tube he firmly fix'd to the Plain of a *Mural Arch*, which had been for above 30 Years immoveably cemented to the Wall of the *Royal Obſervatory*, to which he choſe to fix it, becauſe of the great Solidity thereof, and its being therefore the leſs liable to ſhake; and that after having ſtood 30 Years, there was no fear of its ſettling any further in the ſpace of one Year; beſides, that it was eaſy to perceive if any ſuch alteration ſhould happen to it.

Having therefore fix'd his three Foot Tube as above, ſo that, about the beginning of *April*, 1714. *New Stile*, (I ſuppoſe, becauſe then *Sirius* was in *Square* to the *Sun*) the Star being exactly in the *Meridian*, paſt over the Center of the Tube, he obſerved that on the 20th of *April* the Star touched the Horizontal Thread with its under edge, being apparently all above it, in the inverting Tube, but really below. On the 15th of *May*, and 6th of *June*, it paſt again by the Center. On *June* the 27th it appeared a little under, and on *July* the 9th it was found to touch the under part of the Thread. On *October* the 5th it again paſt by the Center; but on *December* the 29th, it touched the upper part of the Thread. *January* the 18th, 1715. being the coldeſt Day of that Winter, it paſt exactly by the Center; and on the 27th of *March*, and the 1ſt of *April*, it almoſt touched the upper ſide of the Horizontal Thread, from which it ſeem'd a little ſeparated. But on *June* the 7th, it paſt a little under the Center; and on *June* the 29th, the *Sun* being then in conjunction with *Sirius*, it paſt under the Thread, ſo as to touch it with its upper edge. Whence it appears, that in the ſpace of the whole Year, there had been no other variation of the *Meridian* Altitude of *Sirius*, than the breadth of the Thread, which

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appear'd equal to the Diameter of the Star, which he takes to be five, or at moſt ſix Seconds.

Suppoſing this to be ſo, he then ſhews that the whole Diameter of the annual Orb is to the diſtance of *Sirius*, as the Sine of 6″ to the Sine of 39° 33 the Latitude of the Star, whence the aforeſaid immenſe magnitude of the Body thereof, is a neceſſary Conſequence.

But before this obtain a full aſſent, it may not perhaps be amiſs to enquire whether the ſuppos'd viſible Diameter of *Sirius*, were not an Optick Fallacy, occaſioned by the great contraction of the *Aperture* of the *Object Glaſs:* For we all know that the Diameters of *Aldebaran* and *Spica Virginis*, are ſo ſmall, that when they happen to immerge on the dark Limb of the *Moon*, they are ſo far from looſing their Light gradually, as they muſt do were they of any ſenſible magnitude, that they vaniſh at once with their utmoſt Luſtre; and emerge likewiſe in a Moment, not ſmall at firſt, but at once appear with their full Light, even tho' the Emerſion happen very near the *Cuſp*; where, if they were four Seconds in Diameter, they would be many Seconds of Time in getting entirely ſeparated from the Limb. But the contrary appears to all thoſe, that have obſerved the Occultations of theſe bright Stars. And tho' *Sirius* be bigger than either of them, yet he is by far leſs than two of them; and conſequently his Diameter to theirs is leſs than the Square Root of 2 to 1, or than 1.4 to 10; whence, in Mr. *Caſſini*'s excellent 36 Foot Glaſs, thoſe Stars ought to be about four Seconds in Diameter; and they would undoubtedly appear ſo, if view'd after the ſame manner; whereas we are *aliundè* certain, that they are leſs than one ſingle Second in Diameter. The great ſtrength of their native Light, forming the reſemblance of a Body, when it is nothing elſe but the ſpiſſitude of their Rays.

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As to the other part of the Argument, that the alteration of the declination of *Sirius*, on the ſcore of the acceſs of the Earth in *December*, and its receſs in *June*, amounts to 6 Seconds; I can only remark, that, beſides that a *Radius* of 3 Feet, as it ſeems that made uſe of was no more, is ſomewhat too ſmall for ſo extremely nice an Obſervation, 6″ being ſubtended by the $\frac{1}{1000}$ part of an Inch, ſome of the Obſervations before recited do plainly ſhew, that the *Refraction* of the *Medium* did intermix with thoſe Differences that might be occaſioned by the *Parallax*.

But the principal Objection againſt the Concluſion of this Argument, ſeems to be, that the Meridian altitude of *Sirius* at *Paris* being under 25 Degrees, the ordinary Refraction of the Star is 1′ 55″ or 115 Seconds; and the Barometer riſing and falling above two Inches in Thirty, ſhews that the *denſity* of the *Air*, on that ſcore, may be a 15th part more at one time than another. Whence the Refractions being always proportional to the *denſity* of the *Medium*, as we have all ſeen it often demonſtrated by Mr. *Hawksbee*, both in *Vacuo*, and in a *doubly* and *trebly condenſed Air*, it is plain that in that Altitude the Refraction of a Star may differ about 7 or 8 Seconds, or the 15th part of 115″, which is more than the whole *Parallax* ſuppoſed to have been obſerved.

It were to be wiſh'd that Mr. *Caſſini* would pleaſe to try this Matter by the *Lucida Lyræ*, inſtead of *Sirius*, which, tho' ſomewhat leſs than him, is as near to the *Soſtitial Colure*, and has much greater Latitude, being but 28 *grad.* from the *Pole* of the *Ecliptick*, whence its Parallax would be ſo much greater; and being at *Paris* within 10 *grad.* of the *Zenith*, the grand Objection of the difference of Refraction, would be almoſt wholly removed.